

Appendix C:

Missile Systems -- Work Breakdown Structure and Definitions

C.1 -- Scope

This appendix provides the missile system work breakdown structure. Definitions for the missile air vehicle and command and launch equipment are provided in this appendix. Definitions for WBS elements common to all defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

C.2 -- Applicable Documents

Non-Government Publications.

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

American National Standards Institute (ANSI)

ANSI/IEEE STD 610.12, *Standard Glossary of Software Engineering Terminology*

(Application for copies should be addressed to ANSI Customer Service, 11 West 42nd Street, New York, NY 10036.)

C.3 -- Work Breakdown Structure Levels

Level 1	Level 2	Level 3
Missile System	Air Vehicle	Propulsion (Stages I..n,] Payload Airframe Reentry System Post Boost System Guidance and Control Ordnance Initiation Set Airborne Test Equipment Airborne Training Equipment Auxiliary Equipment Integration, Assembly, Test and Checkout
	Command and Launch	Surveillance, Identification and Tracking Sensors

	Launch and Guidance Control Communications Command and Launch Applications Software Command and Launch System Software Launcher Equipment Auxiliary Equipment
Systems Engineering/ Program Management	Development Test and Evaluation
System Test and Evaluation	Operational Test and Evaluation Mock-ups Test and Evaluation Support Test Facilities
Training	Equipment Services Facilities
Data	Technical Publications Engineering Data Management Data Support Data Data Depository
Peculiar Support Equipment	Test and Measurement Equipment Support and Handling Equipment
Common Support Equipment	Test and Measurement Equipment Support and Handling Equipment
Operational/Site Activation	System Assembly, Installation and Checkout on Site Contractor Technical Support Site Construction Site/Ship/Vehicle Conversion
Industrial Facilities	Construction/Conversion/Expansion Equipment Acquisition or Modernization Maintenance (Industrial Facilities)
Initial Spares and Repair Parts	

C.4 -- Definitions

C.4.1 -- Missile System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce the capability of employing a missile weapon in an operational environment to produce the destructive effect on selected targets.

C.4.2 -- Air Vehicle

The primary means for delivering the destructive effect to the target.

Includes:

- the capability to generate or receive intelligence, to navigate and penetrate to the target area, and to detonate the warhead
- the design, development, and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use)
- Sub-elements to the air vehicle (C.4.2.1 -- C.4.2.11)

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.1 -- Propulsion (Stages I..n, As Required)

The thrust to propel the air vehicle on its intended flight. The propulsion system may be composed of one or more stages which ignite, burn, and are jettisoned sequentially over the course of missile flight. The propulsion element may be solid, liquid, or air-breathing.

Includes, for example:

- structure (integral to the propulsion system), propellant, controls, instrumentation, and all other installed subsystem equipment integral to the rocket motor or engine as an entity within itself
 - design, development, production, and assembly efforts to provide each stage as an entity
- 1) ***Rocket Motor/Booster.*** The solid propulsion system which carries within it both the fuel and oxygen required for its operation.

Includes, for example:

- an arm and firing device, solid propellant, movable nozzles, casings, integration, etc.

2) *Engine*

The engine includes both liquid propulsion systems and air breathing systems.

- Liquid propulsion engine includes, for example:
 - the main engines, verniers/auxiliary engines, fluid supply system, liquid propellant, attitude control equipment, structure (integral to the engine), raceway, interstage, combustion section, turbines, nozzles, rotors, etc.
- Air breathing engines obtain oxygen from the surrounding atmosphere to support the combustion of its fuel. Includes, for example:
 - Ramjets and turbojets which may be used to provide propulsion for cruise type missiles
 - mainframe, compressor, combustion section, air inlets/exhaust ducts, turbine nozzle assembly, turbine rotor, bearings and housings, and fuel subsystem
 - air breathing systems which require various accessory components such as pumps, injectors, turbines, motors, diffusers, and igniters

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.2 – Payload

The warhead and its support assemblies where no reentry system exists. Normally, payload consists only of the warhead and its associated arming and fuzing equipment. However, with complex munitions containing submunitions, the payload subsystem may mimic the larger system by having its own guidance and control, fuze, safe-arm, and propulsion.

Includes, for example:

- arming and fuzing device, warhead, and target detection device

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.3 – Airframe

The structural framework that provides the aerodynamic shape, mounting surfaces and environmental protection for the missile components which are not directly applicable to other specific level 3 air vehicle subsystems.

Includes, for example:

- endo-atmospheric missiles
 - wings and fins which provide aerodynamic flight control in response to electro-mechanical signals and are attached to the missile body
 - structural body assemblies including the structure, covers, such as passive nosepieces, skins, adhesives, and fairings not directly applicable to any other level 3 air vehicle subsystem

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.4 -- Reentry System

For exo-atmospheric missiles, the reentry system is the aggregate of prime equipment items consisting of a deployment module, reentry vehicles, payload, penetration aids and ascent shroud, which provide structural support and environmental protection of nuclear payloads during the ground deployment and flight. Includes, for example:

- reentry vehicle (aero-structure) which provides reentry protection for the internally carried warheads
 - for independent maneuvers, the reentry vehicle will contain navigation, guidance, control, sensors, and processing systems which provide the reentry systems capability to acquire and track targets and execute the necessary flight path to the selected target
- the arming and fuzing system which provides the proper electrical signals to detonate the warhead

Excludes:

- All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle

C.4.2.5 -- Post Boost System

- exo-atmospheric missiles -- provides the roll rate control and the final velocity to adjust and deploy the payload
- single warhead missile -- structure, external protection material, velocity control system, and deployment group
- multiple warhead missile -- structure, axial engines, attitude control equipment, propellant storage assembly, and pressurized system

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.6 -- Guidance and Control

The equipment used to control the missile flight to the target.

Includes, for example:

- functions -- acquiring and tracking targets, receiving guidance intelligence data from various sources (including sensors and feedback from control commands) to follow the necessary flight path to intercept the target
 - inputs -- interface status, inertial acceleration, and attitude changes
 - outputs -- missile control, ordnance firing commands, status, instrumentation, and timing signals
- flight electrical power, missile electrical interconnection, and structure to contain the guidance and control components when the structure is not part of a separately identified airframe element

1) exo-atmospheric missiles

missile cables, stage cables, stage connectors, airborne power supply, electronic battery, ordnance battery, ordnance initiation set, missile electronic and computer assembly, inertial measurement unit, the guidance and control software, in-flight coolant assembly, and guidance and control integration, assembly, test, and checkout

2) endo-atmospheric missiles

seekers, mission computer, global positioning receiver, inertial platform, inertial sensors, altimeter, data link, power subsystems, windows/domes, distributive systems, autopilot, flight control actuators, guidance and control software, and guidance and control integration, assembly, test, and checkout

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.7 -- Ordnance Initiation Set

In exo-atmospheric missiles, the ordnance initiation set initiates all ordnance events throughout the missile and ground system (except reentry system components). Upon receipt of an electrical signal from the missile guidance and control system, the ordnance initiation set firing units convert the signal into ordnance outputs to the detonating cords. Among these ordnance events are stage separation, motor ignition, gas generator ignition, shroud separation, etc.

Includes, for example:

- through bulkhead initiators, ordnance test harnesses, and firing units/exploding bridgewires

Excludes:

- All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test and checkout of these elements into the air vehicle

C.4.2.8 -- Airborne Test Equipment

The instrumented payload that is interchangeable with the live warhead and suitable for developmental test firing.

Includes, for example:

- recovery systems, special instrumentation, telemetry equipment, etc.

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.9 -- Airborne Training Equipment

The exercise payload that is interchangeable with the live warhead and suitable for training firing.

Includes, for example:

- recovery systems, special instrumentation, telemetry equipment, etc., associated with the training mission

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.10 -- Auxiliary Equipment

The additional equipment generally excluded from other specific level 3 elements.

Includes, for example:

- environmental control, safety and protective subsystems, destruct systems, etc., if these were not accounted for in other WBS elements
- equipment of a single purpose and function which is necessary for accomplishing the assigned mission

Note: *All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded.*

C.4.2.11 -- Integration, Assembly, Test and Checkout

The integration, assembly, test and checkout element includes all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide a complete missile.

C.4.3 -- Command and Launch

The subsystems installed at a launch site or aboard launch vehicles required to store, make ready, and launch the air vehicles of the missile system.

Includes:

- those equipments required to acquire and condition the necessary intelligence of selected targets, reach launch decisions, command the launch, and provide guidance and control where such capability is not self contained aboard the air vehicle
- design, development and production of complete units (i.e., the prototype or operationally configured units which satisfy the requirements of their applicable specification(s), regardless of end use)
- Sub-elements to the command and launch element (C.4.3.1 -- C.4.3.7)

C.4.3.1 -- Surveillance, Identification, and Tracking Sensors

The sensors required to support missile systems by maintaining surveillance against incoming targets and providing the data required for targeting, launch, midcourse guidance, and homing where such capability is not self-contained aboard a missile system air vehicle. For all classes of missiles:

Includes, for example:

- tracking of the missile system air vehicles as required for guidance and control or range safety
- sensors of any spectrum (radar, optical, infrared, etc.) which are external to the air vehicle

Excludes:

- Subsystems used in safety, destruct, test, or training activities
- unless they are required operational items

C.4.3.2 -- Launch and Guidance Control

The equipment to target air vehicles, make launch decisions, and command launch.

Includes, for example:

- control and checkout console, data displays, secure code device, programmer group, communication control console, command message processing group, and digital data group
- equipment at the launch facility/vehicle and/or the launch control center(s) (air, sea, or mobile)
- launch code processing system

C.4.3.3 -- Communications

The equipment, not resident on the air vehicle, which distributes intelligence between the air vehicle and the command and launch equipment.

Includes, for example:

- inter-communication subsystems of launch sites for tactical and administrative message flow and ties between sensor, data processing, launch, and guidance control subsystems
- communications may interface with existing fixed communication facilities or communication subsystems of launch platforms which are associated systems to the missile system

C.4.3.4 -- Command and Launch Applications Software

All the software required to direct and perform the operations of the command and launch equipment (ref. ANSI/IEEE Std 610.12).

Includes, for example:

- effort required to design, develop, integrate, and checkout the command and launch applications computer software configuration items (CSCIs)

Excludes:

- non-software portion of command and launch firmware development and production

Note: ***When the opportunity to collect lower level information exists, the structure and definitions in Appendix B, Electronic/Automated Software Systems, will be used.***

C.4.3.5 -- Command and Launch System Software

The software designed for a specific computer system or family of computer systems to facilitate the operation and maintenance of the computer system and associated programs; for example, operating systems, compilers, and utilities (ref. ANSI/IEEE Std 610.12).

Includes, for example:

- all effort required to design, develop, integrate, and checkout the command and launch system software
- all software developed to support any command and launch applications software development
- command and launch system software which is required to facilitate development, integration, and maintenance of any command and launch software CSCI

Excludes:

- all software that is an integral part of any specific hardware subsystem specification or specifically designed and developed for system test and evaluation

Note: ***When the opportunity to collect lower level information exists, the structure and definitions in Appendix B, Electronic/Automated Software Systems, will be used.***

C.4.3.6 -- Launcher Equipment

The means to launch the missile air vehicle from stationary sites or mobile launch platforms.

Includes, for example:

- vehicles, rail launchers, canisters, capsules, tubes, pods, and devices which support, suspend, or encase the air vehicle for firing
- associated hardware such as umbilicals, harnesses, pyrotechnics, and electronics
- storage facilities and checkout stations for readiness verification when these are integral to the launcher
- safety and protective elements when these are not integral to the launch platform or site facilities

C.4.3.7 -- Auxiliary Equipment

The general purpose/multi-usage ground equipment utilized to support the various operational capabilities of the command and launch equipments which is generally excluded from other specific level 3 elements.

Includes, for example:

- power generators, power distribution systems, environmental control, cabling, malfunction detection, fire prevention, security systems, and other common-usage items not applicable to specific elements of the ground based equipment

C.4.4 -- Common WBS Elements

Definitions for common WBS elements applicable to the missile and all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.